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## NOTES ON THE COCHINEAL INSECT.

BY T. D. A. COCKERELL.

The following notes have been put together in the hope that they may tend towards a better understanding of the genus *Coccus*, as now restricted. Notwithstanding the voluminous literature on the subject of cochineal, it cannot be said that the insect producing this substance is adequately known to entomologists, or that the affinities of the genus in which it is placed are altogether well understood.

At the outset we have to inquire, what is *Coccus cacti*? According to Watt (Dict. Econ. Prod. India, Vol. II), it was discovered by the Spaniards in Mexico in 1518, but was not made known in Europe until 1523. The name *Coccus cacti* seems to have been applied to it as early as 1651 by Hernandez, but of course the species is now credited to Linné.

*Coccus cacti* Linné, as understood by its author, is simply the cochineal-producing insect found on cacti in Mexico. It need hardly be said that minute details, such as are now considered of generic and specific importance in the Coccidæ, were not taken into account in the definition of the species.

In the present century, however, it began to be suspected that there was more than one species. Signoret, writing about twenty years ago, mentions three segregates from the old *C. cacti*, namely, *C. tomentosus* Lam., *C. bassi* Targ., and *C. sylvestre* Thierry; de Meronville. These, he says, are supposed species,

based on specimens from Mexico, presenting differences in color and the amount of cottony matter.

In the same work (*Essai sur les Cochenilles*) Signoret gives a definition of *C. cacti* which may be taken as fixing the strict application of the name. Properly, therefore, the insect is *Coccus cacti* L., sens. Sign., and its principal characters are as follows:

*Female.* Dark red-brown, 6 to 7 mm. long, 4 wide, 2 to 3 high, with a great quantity of white cottony matter. Segmentation distinct. Back more or less keeled. Antennæ short, conical, 7-jointed, the four basal joints short, wider than long; joint 7 as long as the two before it together. Larva with 6-jointed antennæ.

*Male.* Red-yellow, legs and antennæ brown. Antennæ 10-jointed, hairs on antenna knobbed.

In Ashmead's Generic Synopsis of the Coccidæ, the genus *Coccus* forms a tribe Coccini, distinguished from the tribe Acanthococcini by no very tangible characters. It is stated that the male is apparently without ocelli (see however, Signoret's figure) and the adult ♀ lacks the bristles on the anal ring. Maskell (New Zealand Scale Insects) had earlier placed *Coccus* in a subdivision by itself, defined thus: "Adult females active, covered with mealy secretion; antennæ of seven joints; no hairs on anogenital ring. Eyes of male not faceted."

The question as to there being two or more species, after being answered in the negative by Signoret, was again raised in 1884 by Lichtenstein. This entomologist had received specimens from Mexico which he considered to be the *Coccus tomentosus* Lam.; but he not only regarded this species as distinct from *cacti*, but transferred it to *Acanthococcus*—a genus known hitherto only from Europe and New Zealand.

The nomenclature of the Cochineal insects, according to the latest researches, is, therefore:

Tribe COCCINI. Genus COCCUS L., Sign.

COCCUS CACTI L., Sign.

Tribe ACANTHOCOCCINI. Genus ACANTHOCOCCUS Sign.

ACANTHOCOCCUS TOMENTOSUS (Lam.) Licht.

So the genus *Coccus* would still remain monotypic, were it

not that in 1888 Mr. Douglas described a *Coccus agavium*, found on *Agave*—not a cochineal insect. It is true that the recent literature contains some other nominal species of *Coccus*, such as *C. laniger* W. F. Kirby, 1891, but in so placing them, their authors have reverted to the Linnean use of the term, ignoring genera as now defined.

From an examination of cochineal insects from Jamaica, Mexico, and New Mexico, I have come to the conclusion that the above-mentioned definition and classification need entire revision. This conclusion may be wrong, and was only reached with much hesitation—but it seems sufficiently clear after considering all the evidence.

The specimens examined are:

1. From the Parade Garden, Kingston, Jamaica, on *Opuntia*: = *Coccus cacti* L.

2. From Silao, Mexico, on *Opuntia tuna*, from Dr. A. Dugès: = *Coccus tomentosus* Lam.

3. From Guanajuato, Mexico, from Dr. A. Dugès: = *Coccus tomentosus* Lam.

4. From Las Cruces, New Mexico: = *Coccus confusus* n. sp.

The Silao insect is Lichtenstein's *Acanthococcus*; there can be no doubt about this as Lichtenstein had his specimens from Dr. Dugès, who assures me they are the same. All the others, however, are strictly congeneric with this, and therefore either *Acanthococcus tomentosus* is a *Coccus*, or all belong to *Acanthococcus*.

*Acanthococcus*, as stated above, has been recorded from Europe and New Zealand. Maskell sinks the genus as a synonym of *Eriococcus*, which he defines thus:

“Adult female enclosed in an elongated sac of white or yellow felted cotton; body elongated, segmented; anal tubercles conspicuous; feet and antennæ present; several rows of conical spines on dorsal surface. Antennæ of six joints.” The anogenital ring is also said to have hairs.

This does not precisely agree with *C. tomentosus*, but on comparing that insect with the published descriptions of *Eriococcus* spp., the affinity is evident.

The Jamaican specimens agree very closely with *Coccus cacti*,

but are certainly of the same genus as *tomentosus*. If they are not *C. cacti*, they represent a new species exceedingly like it—a view of the case which seems wholly untenable.

The conclusion, therefore, at which I arrive is that *Coccus*, as typified by *C. cacti*, is a genus very near to *Eriococcus*, and not by any means to be separated as a different tribe. Also, that the cochineal insect includes three or more closely allied species or races. It will be useful to consider the characters in detail.

### COCCUS L., Sign.

#### *Adult Female.*

*Size*.—*Coccus cacti*, according to Signoret, is from 6 to 7 mm. long. *C. tomentosus*, from Guanajuato, varies from  $3\frac{1}{2}$  to nearly 5 mm. in length.

*Shape*.—The species are broadly oval; the keel seen by Signoret is more due to shrinkage in drying than anything else. *C. tomentosus* may be described as hemispherical, with the hind end a little pointed.

*Color*.—All give the characteristic cochineal color, and so far as this is concerned, I see little difference. *C. tomentosus* placed in caustic soda without heating, gives a beautiful reddish-violet color; on boiling, this turns bright crimson. This was observed in Guanajuato specimens; of Silao examples I noted that heated in caustic soda they gave a magenta color, very strong, which, by transmitted light, was bright violet, like log-wood staining.

*C. confusus*, boiled in soda, gave a very fine, bright carmine.

The under surface of *C. tomentosus*, where free from secretion, appears dark purplish in the living insect. Signoret says *C. cacti* is dark red-brown; those from Jamaica are better described as dark greyish. In Ency. Brit., 9th Ed. (1877), the ♀ of *cacti* is described as dark brown. *C. cacti* has been introduced in Madeira, and I found it there on *Opuntia* in 1879. I have a water-color drawing made of it at the time, and it is represented as dark bluish-gray, not at all reddish.

*Secretion*. The secretion is better described as cottony than mealy. As noticed by Signoret, it differs in the several races,

and these differences cannot be held to have generic value. In *C. confusus* and the Jamaican *C. cacti*, the secretion is profuse, so that the individuals are hidden in it, and separated with difficulty. In the Madeira *C. cacti*, it is much more sparse, allowing the gray color of the females to be seen. In *C. tomentosus* it forms a sac covering the insect, after the manner of *Eriococcus*; in the smaller specimens, part of the body below is free, but larger ones are entirely covered by secretion. The individuals of *C. tomentosus* in their woolly sacs, are easily separable from one another.

*Activity*.—Maskell writes for *Coccus*, "adult female active;" as against the stationary females of *Eriococcus*, etc. This supposed character is valueless; the final state of female *Coccus* is one of inactivity.

*Antennæ*.—The antennæ are very small, and show plain evidence of degeneration. In *C. cacti* from Jamaica I could plainly see the seven joints; the first large, the second broad and very short, the third longer but still broader than long, the fourth perhaps as long as the third but not so broad, the fifth and sixth about as broad as long, and the seventh decidedly longer than broad, rounded, emitting two or more hairs. All this agrees excellently with Signoret's *cacti*.

*C. tomentosus* also shows seven joints, practically as in *cacti*, except that the fourth joint is longer in proportion. *C. confusus* has the antennæ more degenerated, five-jointed, all the joints broader than long except the last; third shortest, last emitting about seven hairs.

*Legs*.—In *C. confusus* I found all the legs present and well-developed, though small. Femur about as long as tarsus and tibia; tibia decidedly shorter than tarsus. In *C. tomentosus* the legs are stouter than in *confusus*, the tibia about as long as the tarsus, but if any difference, the tibia is the shorter. Femur very stout, and about as long as tarsus and tibia. The tibia is broader than the tarsus; the claws large. The usual knobbed hairs at end of tarsus are present.

*Truncate Spines*.—The skin of all three species shows numerous truncate processes, which no doubt represent the spines of the larva and of the species of *Eriococcus*. These processes

consist of two parts, a broad ring-like basal part, and a cylindrical sharply truncate terminal part. In *C. confusus* these processes are decidedly more slender than in *C. tomentosus*, the latter being characterized by their great thickness. In *C. cacti* from Jamaica they are also thick, practically as in *tomentosus*.

*Grouped Orifices.*—Little groups of glands, like those of the Diaspinæ, are seen among the spines. These groups are compact and very clearly circumscribed, and are quite obvious in *C. cacti* (Jamaica) and *C. confusus*. In the latter, some groups are of three orifices only, but usually there are many, perhaps averaging about 15.

*Viviparous Habit.*—*C. confusus* was found to have the body full of well-formed larvæ. *C. tomentosus*, from Silao, which had been long in alcohol, were full of larvæ.

#### Immature Stages.

*Color.*—The young of *C. tomentosus* are reddish-purple.

*Antennæ.*—I found 7 joints in the second stage of Jamaican *C. cacti*. In *C. confusus* there seem to be 7 joints in the larva, but two are, perhaps, to be considered false joints; these are in joints 1 and 3. The second, first and fifth (or last) are about equal, the third and fourth shortest. The last four joints emit hairs, one on the fifth being especially long. The antennæ of *C. confusus* appear to degenerate with the growth of the insect.

In the larva of *C. tomentosus*, I found the antennæ 5-jointed, the proportions of the joints as in *Confusus*. The false joint in joint 1 is noticed, but it is evidently not a true joint. Joints 3 and 4 have a peculiar shape, concave on one side, convex on the other. The last joint has four hairs, two of which are long.

The larva of *Coccus* is commonly said to have 6-jointed antennæ. According to Signoret's figures, that of the ♀ has 6 joints, that of ♂ only 5.

*Legs.*—The legs are, of course, much better developed in the larva than the adult, in proportion to the size of the insect. In the leg of a larva of *C. confusus*, I noticed two strong bris-

tles on the inner side of tarsus, and one at distal end of tibia. Tibia shorter than tarsus, but not so much so as in the adult, thus reversing the usual order of events.

In *C. tomentosus* I noted, legs of larva with long claws, and longer tarsal hairs, tibia shorter than tarsus. In Jamaican *C. cacti*, second stage, I noticed the length of the claws.

*Rostral Filaments*.—In the very young larvæ of *C. confusus* and *C. tomentosus*, the rostral filaments are coiled like the spring of a watch, and very conspicuous.

*Anogenital Ring*.—The absence of hairs on the anogenital ring is given as a generic character of *Coccus*; but these hairs, about six in number, were plainly seen in the second stage of Jamaican *C. cacti*.

*Spines*.—All three species have in the larva distinct rows of spines, which run longitudinally down the back, just as Signoret figures for *Capulinia sallei*. In *C. tomentosus* I found two parallel dorsal rows, and two rows on each side of the anterior part of the body, joining to form one row on the posterior half. These spines have sharp points, differently from the truncate processes of the adult.

*Male Sac*.—In *C. tomentosus*, this is white, elongated, about  $1\frac{1}{2}$  mm. long. In Jamaican *C. cacti* it is quite similar.

#### *Adult Male.*

*Size*.—In *C. tomentosus* the body is about 1 mm. long.

*Color*.—The male of *C. cacti* is said to be red-yellow (Signoret) or deep red (Ency. Brit., 9th Ed.). A male of Jamaican *C. cacti*, after being boiled in soda, showed the thorax and genitalia pale brownish, the abdomen pink. In a male not so treated, the wings were observed to be white, appearing granulose, about half their length extending beyond the body.

In a living male of *C. tomentosus*, the body was dark purple-red, the wings whitish subhyaline, the veins not colored. Crushed under a cover-glass, the body gave a brilliant magenta color.

*Caudal Filaments*.—The abdomen of *C. cacti* from Jamaica emits two very long filaments. *C. tomentosus* also shows a pair of long white filaments.



*Antennæ*.—These are 10-jointed, as observed in Jamaican *C. cacti*, and *C. tomentosus*. The two first joints are comparatively short. I noted of *C. tomentosus*: joint 2 subglobose, 3 longest, fusiform; 4, 5 and 6 fusiform, equal, distinctly shorter than 3; 7 *slightly* shorter than 6; 7, 8, and 9 subequal; 10 about as long as 4. Joints with whorls of hairs. *Antennæ* dark reddish, but last joint pale pink. The Jamaican *C. cacti* showed about the same, but 4 longer than 5. I saw no knobbed hairs.

Signoret says the antennæ of *cacti* are brown, and in his figure the fourth and fifth joints are longer, if anything, than the third.

*Legs*.—I noted of *C. tomentosus*: claw long and straight; digitules very slender, filiform, hardly knobbed. Tarsal knobbed hairs well-formed, rather stout. Tibia and tarsus with a row of strong short spines on inner side. Tarsus about two-thirds length of tibia; tibia a little shorter than femur; trochanter with a long hair.

*Scutellum*.—The scutellum in Jamaican *C. cacti* exhibits a distinct median longitudinal furrow.

### Conclusions.

1. Pending the discovery of new facts proving otherwise, I would propose to unite the tribes Acanthococcini and Coccini under the latter name.

2. The genus *Coccus* may be re-defined as consisting of species which have rows of dorsal spines in the larva, truncate dermal processes in the adult female, antennæ 7- or 5-jointed in the ♀, 10-jointed in the ♂, 5- or 6-jointed in the larva, and in the ♀ more or less abundant cottony secretion. The absence of bristles on the anogenital ring of the adult ♀ may also be cited; it was on this ground that Dr. Riley, to whom I sent *C. tomentosus*, objected to its inclusion in *Acanthococcus*, the latter genus having the bristles.

3. The cochineal insect, as commonly understood, may be taken to include three closely allied species, *C. tomentosus* Lam., *C. cacti* Linn., *C. confusus* Ckll., separated by the characters given above. Former records of the occurrence of *C. cacti*

must be held more or less doubtful until specimens are re-examined.

4. *Coccus* may be held to include only the cochineal insects. *Coccus* (*Gymnococcus* Dougl.) *agavium* seems to belong to a separate genus, and may be known as *Gymnococcus agavium*.

5. *Capulinia* seems to be a very closely allied, but still more degenerate genus.

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